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Proposed Re-evaluation Decision PRVD2016-25

Antisapstain and Joinery Uses of Iodocarb

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Background

This document forms part of a wider assessment of health and environmental risks of the active ingredients used in antisapstain and joinery wood treatments.

In 2004, Health Canada's Pest Management Regulatory Agency (PMRA) completed a re-evaluation of the occupational risks for the antisapstain uses of three antisapstain active ingredients: 2-(thiocyanomethylthio) benzothiazole (TCMTB), copper-8-quinolinolate (copper-8), and disodium octaborate tetrahydrate (boron). The occupational exposure and risk assessments were conducted for workers at lumber processing facilities such as sawmills. The re-evaluation decision (RRD2004-08) identified the need for additional data to refine the occupational risk assessments and required that a product stewardship program (with follow-up monitoring) be implemented for all registered antisapstain chemicals to reduce exposure to workers. In addition, RRD2004-08 indicated that an assessment of the environmental risks of antisapstain products would be communicated in separate documents.

In response to the 2004 decision, the registrants of antisapstain products, the Sapstain Industry Group, developed a product stewardship program, referred to as the Exposure Reduction Program (ERP). This program was approved by PMRA, implemented for all antisapstain products and follow-up occupational exposure field monitoring was conducted. The ERP included additional personal protective equipment and engineering controls, which have shown to be effective in reducing worker exposure.

There are currently five active ingredients registered as joinery wood preservatives. These active ingredients are: boron, didecyl dimethyl ammonium chloride (DDAC), iodocarb, propiconazole and tebuconazole. Considering that the occupational exposure scenarios for antisapstain and joinery uses are similar, and in the interest of efficiencies and consistency in decision making, occupational risk assessments were also conducted for all joinery products using the Sapstain Industry Group's follow-up field monitoring exposure data.

Altogether, seven active ingredients registered as antisapstain and/or joinery wood preservatives required updated health and environmental risk assessments. These active ingredients are: TCMTB, copper-8-quinolinolate, boron, DDAC, iodocarb, propiconazole, and tebuconazole. The occupational risk assessments for these seven antisapstain and joinery active ingredients have been updated using current use information, current toxicology endpoints and the follow-up field monitoring exposure data. The environmental risk assessments have been conducted using available data and information.

This document addresses the health and environmental risk assessments for the antisapstain and joinery uses of iodocarb. The re-evaluation of the antisapstain and joinery uses of the remaining active ingredients listed above will be communicated in separate documents.

Overview

Proposed Re-evaluation Decision for Antisapstain and Joinery Uses of Iodocarb

The PMRA has completed the health and environmental risk assessments for the antisapstain and joinery uses of iodocarb. Under the authority of the *Pest Control Products Act*, the PMRA is proposing continued registration of the antisapstain and joinery uses of iodocarb in Canada.

An evaluation of available scientific information found that the antisapstain and joinery uses of iodocarb products are not expected to pose risks of concern to human health or the environment when used according to the proposed revised label directions. As a requirement for the continued registration of antisapstain and joinery products containing iodocarb, new risk-reduction measures are proposed.

This proposal affects the joinery and antisapstain end-use products containing iodocarb registered in Canada. Once the final re-evaluation decision is made, the registrant will be instructed on how to address any new requirements.

This Proposed Re-evaluation Decision is a consultation document[1] that summarizes the science evaluation for iodocarb and presents the reasons for the proposed re-evaluation decision. It also proposes additional risk-reduction measures to further protect human health and the environment.

The information is presented in two parts. The Overview describes the regulatory process and key points of the evaluation, while the Science Evaluation provides detailed technical information on the assessment of iodocarb.

The PMRA will accept written comments on this proposal up to 90 days from the date of publication of this document. Please forward all comments to Publications (please see contact information indicated on the cover page of this document).

What Does Health Canada Consider When Making a Re-evaluation Decision?

The key objective of the *Pest Control Products Act* is to prevent unacceptable risks to people and the environment from the use of pest control products. Health or environmental risk is considered acceptable[2] if there is reasonable certainty that no harm to human health, future generations or the environment will result from use of, or exposure to, the product under its conditions or proposed conditions of registration. Conditions of registration may include special precautionary measures on the product label to further reduce risk. The Act also requires that products have value[3] when used according to the label directions.

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1 "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

2 "Acceptable risks" as defined by subsection 2(2) of the *Pest Control Products Act*.

3 "Value" as defined by subsection 2(1) of the *Pest Control Products Act*: "... the product's actual or

To reach its decisions, the PMRA applies hazard and risk assessment methods as well as policies that are rigorous and modern. These methods consider the unique characteristics of potentially sensitive subpopulations in both humans (for example, children) and organisms in the environment (for example, those most sensitive to environmental contaminants). These methods and policies also consider the nature of the effects observed and the uncertainties present when predicting the impact of pesticides. For more information on how the PMRA regulates pesticides, the assessment process and risk-reduction programs, please visit the Pesticides and Pest Management section of Health Canada's website.

For more details on the information presented in this Overview, please refer to the Science Evaluation of this consultation document.

What is Iodocarb?

Iodocarb is an antimicrobial active ingredient registered for preservation of joinery wood products and as a sapstain control chemical. In addition to its uses as an antisapstain and for joinery, iodocarb is registered in Canada as a preservative in various materials (textiles, adhesives, caulks, paints, latex paper coating, plastic, water-based inks, metal working fluids) and a variety of consumer products (including household cleaning products).

Antisapstain products are wood preservatives used to prevent the growth of staining fungi in freshly cut lumber. They are applied to freshly-cut wood by dipping or spraying to achieve short-term (months) protection against staining fungi.

Wood products that have been manufactured into items such as windows and doors are referred to as joinery or millwork. These items are often used in above-ground settings where they are subject to moderate decay conditions. For this reason, wooden windows and doors are typically protected with a joinery wood preservative to prevent the growth of decay fungi and increase the service life. Unlike antisapstain treatments, which are applied to lumber for short-term protection against aesthetic damage, joinery preservatives provide long-term decay protection to wood that does not require the degree of protection provided by heavy-duty wood preservation.

Health Considerations

Can Approved Uses of Iodocarb Affect Human Health?

Antisapstain and joinery products containing iodocarb are unlikely to affect your health when used according to revised label directions.

Potential exposure to 3-iodo-2-propanyl butyl carbamate (iodocarb) may occur through the dermal and inhalation routes, when handling and applying antisapstain and joinery products containing iodocarb or by handling the treated wood. When assessing health risks, two key

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potential contribution to pest management, taking into account its conditions or proposed conditions of registration, and includes the product's (*a*) efficacy; (*b*) effect on host organisms in connection with which it is intended to be used; and (*c*) health, safety and environmental benefits and social and economic impact".

factors are considered: the levels at which no health effects occur in animal testing and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). Only uses for which exposure is well below levels that cause no effects in animal testing are considered acceptable for continued registration.

Toxicology studies in laboratory animals describe potential health effects from varying levels of exposure to a chemical and identify the dose where no effects are observed. The health effects noted in animals occur at doses more than 100-times higher (and often much higher) than levels to which humans are normally exposed when pesticide-containing products are used according to label directions.

In laboratory animals, iodocarb was slightly toxic via the oral and inhalation routes, of low acute dermal toxicity, a severe eye and mild dermal irritant, and did not cause an allergic skin reaction.

Registrant-supplied short-, and long-term (lifetime) animal toxicity tests were assessed for the potential of iodocarb to cause neurotoxicity, immunotoxicity, chronic toxicity, cancer, reproductive and developmental toxicity, and various other effects. The most sensitive endpoints for risk assessment were reproductive and developmental effects (decreased survival and developmental retardation). The risk assessment protects against the above-noted effects by ensuring that the level of human exposure is well below the lowest dose at which these effects occur in animal tests.

Risks in Residential and Other Non-Occupational Environments

Non-occupational risks are not of concern.

There are currently no registered residential uses of iodocarb antisapstain or joinery products. As such, a risk assessment for a residential handler was not required.

Occupational Risks to Mixer/Loader/Applicator and Postapplication Workers

Occupational risks are not of concern when used according to the revised label directions.

Health risks to handlers are not of concern for all scenarios. Based on the updated personal protective equipment (PPE) required as a result of the Exposure Reduction Program (ERP) for Antisapstain Chemicals (see Section 3.4.3), health risk estimates associated with mixing, loading, and applying activities and during handling of treated wood exceeded target dermal margins of exposure (MOEs) and are not of concern. Inhalation exposure was shown to be very low for the majority of workers and is mitigated by the use of a NIOSH-respirator for specific job tasks where there is potential for inhalation exposure, as described in the ERP. Current product labels that do not include all of the required elements of the personal protective equipment will be updated to conform to the ERP.

Postapplication risks are not of concern.

Postapplication exposure through contact with dried wood is not anticipated as antisapstains are designed to prevent the growth of staining fungi in freshly cut lumber during storage and transit and not for long-term wood protection in residential or commercial areas. Similarly, exposure to consumers from contact with treated wood is also considered to be minimal.

Joinery wood is intended for use in millwork, window and door frames and other above ground non-structural decorative exterior wood such as soffits and fascia. Significant human exposure is not expected for this type of wood.

No health risks of concern were identified for workers handling freshly treated wood (wet or dry) in the sawmill. Since this type of exposure is expected to be greater than for workers or bystanders handling treated wood or joinery products after they have left the sawmill, postapplication health risks are not of concern.

Environmental Considerations

What Happens When Iodocarb Is Introduced Into the Environment?

When used as an antisapstain according to the revised label directions, iodocarb is not expected to pose risks of concern to the environment.

Antisapstains, such as iodocarb, may enter the environment if newly treated wood is exposed to rain. Iodocarb may reach the aquatic environment if any rainwater containing the chemical is permitted to run-off from the treatment facility and its wood storage areas into nearby waterbodies. Very little exposure to land organisms and their habitats is expected.

Iodocarb breaks down quickly in the presence of water at high pH but does not break down at low pH. In the presence of microbes, iodocarb breaks down quickly in water and soil, forming propargyl butyl carbamate, which breaks down rapidly. Iodocarb is expected to be mobile to very mobile in mineral soils; however, because iodocarb breaks down quickly, it is not expected to enter groundwater. Residues of iodocarb are not expected to be found in air and are not expected to accumulate in the tissues of organisms. Iodocarb is toxic to freshwater and marine fish, aquatic invertebrates, and amphibians, if they are exposed to high enough levels. A conservative risk assessment indicated a potential risk to aquatic organisms. However, considering the conservative nature of the assessment and the required mitigation, the risks are considered acceptable.

Value Considerations

What is the Value of Iodocarb in Antisapstain Treatment?

Iodocarb is one of several active ingredients currently registered in Canada for use in antisapstain products. Antisapstain products are wood preservatives used to prevent the growth of staining fungi in freshly cut lumber. These pigmented fungi consume the readily available sugars and starches as they grow throughout the sapwood. While these sapstain fungi do not reduce the

strength of the wood, the aesthetic damage done can result in significant economic losses in terms of the lumber being unmarketable or reduced in value.

What is the Value of Iodocarb in Joinery Treatment?

Iodocarb is one of five active ingredients currently registered in Canada for use in joinery products. Joinery products are wood preservatives used to treat products that have been machined or milled, such as window frames or doors. While these window frames and doors tend to be sheltered from excessive rains, they are still susceptible to fungal decay. Treatment with joinery products containing iodocarb inhibits the growth of decay fungi and extends the service life of wooden joinery components.

Proposed Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human health and the environment. Following these directions is required by law. As a result of the re-evaluation of the antisapstain and joinery uses of iodocarb, the PMRA is proposing further risk-reduction measures in addition to those already identified on iodocarb product labels.

Additional Key Risk Reduction Measures

Human Health

To protect workers, additional general hygiene statements and personal protective equipment are required on all iodocarb antisapstain and joinery product labels conforming to the ERP.

Environment

To minimize the amount of iodocarb entering aquatic environments, wood treatment facilities using iodocarb antisapstains are to be equipped with drip pads (where wood is allowed to sit for a short drying period immediately after treatment) that are roofed and paved.

Precautionary label statements are required to identify environmental hazards and prevent run-off from treatment facilities to waterbodies.

Next Steps

Before making a final re-evaluation decision on the antisapstain and joinery uses of iodocarb, the PMRA will consider any comments received from the public in response to this consultation document. A science-based approach will be applied in making a final decision on iodocarb. The PMRA will then publish a Re-evaluation Decision that will include the decision, the reasons for it, a summary of comments received on the proposed decision and the PMRA response to these comments.

Science Evaluation

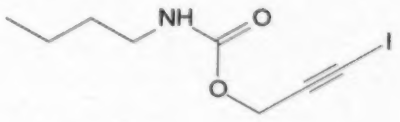
1.0 Introduction

Iodocarb is an antimicrobial active ingredient registered for use as an antisapstain and a joinery wood preservative and as a material preservative (including textiles, adhesives, liquid detergents and metal working fluids).

2.0 The Technical Grade Active Ingredient, Its Properties and Uses

A review of the chemistry was previously conducted as part of the re-evaluation of the non-antisapstain uses iodocarb (PRVD2010-15).

2.1 Identity of the Technical Grade Active Ingredient and the Physical and Chemical

Common name	iodocarb
Function	fungicide, material preservative, wood preservative
Chemical Family	carbamate
Chemical name	
1 **International Union of Pure and Applied Chemistry (IUPAC)**	3-iodoprop-2-yn-1-yl butylcarbamate
2 **Chemical Abstracts Service (CAS)**	carbamic acid, N-butyl, 3-iodo-2-propyn-1-yl ester
CAS Registry Number	55406-53-6
Molecular Formula	$C_8H_{12}INO_2$
Structural Formula	
Molecular Weight	281.09 amu
Purity of the Technical Grade Active Ingredient	97% minimum 97% nominal 99.5% nominal
Registration Number	21750 28422 28583

Based on the manufacturing process used, impurities of human health or environmental concern as identified in the *Canada Gazette*, Part II, Vol. 139, No. 24, SI/2005-114 (2005-11-30), including TSMP Track 1 substances, are not expected to be present in the product.

2.2 Physical and Chemical Properties of the Technical Grade Active Ingredient

Property	Result
Vapour pressure	$0.1 - 3.8 \times 10^{-3}$ Pa
Ultraviolet (UV)/visible spectrum	Not expected to absorb at $\lambda > 300$ nm
Solubility in water	146 – 174 mg/L
n-Octanol/water partition coefficient	$\log K_{ow} = 2.3–2.88$
Dissociation constant	Does not dissociate in environmental pH range

2.3 Description of Registered Iodocarb Uses

Appendix I lists the antisapstain and joinery products containing iodocarb that are registered under the authority of the *Pest Control Products Act*.

Currently, there are five sources of technical grade active ingredients and ten end use products registered with iodocarb, three of which contain co-biocides (DDAC, propiconazole and tebuconazole) in the formulated end use products.

An antisapstain product is applied to freshly-cut wood by dipping or spraying to achieve short-term protection against staining fungi. Joinery products may be applied by dipping, spraying, double vacuum treatment or flow/flood coating.

3.0 Impact on Human and Animal Health

3.1 Toxicology Summary

Urine was the primary route of excretion following oral or intravascular administration of iodocarb (50-70% at 168 h), with a further 18-24% expired in air. Tissue residues were highest in the liver and kidney, declining steadily over 10 days. Skin and skeletal muscle residues declined slowly over the observation period while residues in fat showed little decline, indicating a potential for accumulation in these tissues. Iodocarb appeared to undergo reductive dehalogenation followed by dealkylation to form two metabolites. Decarboxylation following reductive dehalogenation also occurred, yielding carbon dioxide.

Iodocarb was slightly toxic via the oral and inhalation routes in rats, of low acute dermal toxicity in rabbits, a severe eye irritant in rabbits, a mild dermal irritant in rabbits and was not a dermal sensitizer in guinea pigs via either the Maximization or Buehler test.

In a 91-day dermal rat study, dermal irritation reactions were noted at the mid- and high-doses. Decreases in body-weight gain in mid- and high-dose males indicated systemic toxicity at these dose levels. Changes in biochemical parameters and decreased brain cholinesterase levels were observed in a 90-day inhalation study in rats.

Effects in short- and long-term oral toxicity studies included decreased body weight and body weight gain and effects on liver weight, hepatocyte enlargement and stomach mucosa and forestomach lesions in rats. Thyroid effects (increased colloid basophilia in rats; atrophic follicular vacuolation and general follicular enlargement and coalesence in mice) occurred at all dose levels in long-term mouse and rat studies. In mice, high dose females had increased renal pelvic epithelial inflammation, and males had pneumonitis in the lungs. There was a statistically significant increase in the incidence of hepatocellular adenomas and adenomas/carcinomas combined in male mice only; however, iodocarb was considered unlikely to be carcinogenic to humans, as the increase in combined adenoma/carcinoma was driven by the increased incidence of adenomas, there was no response in female mice, or male and female rats, and all in vitro and in vivo genotoxicity tests done with iodocarb were negative. Therefore, a threshold approach to the NOAEL for hepatocellular tumours in male mice was considered appropriate and is consistent with that of other regulatory agencies.

In a dietary multi-generation reproduction study, there were no treatment-related effects in dams; however, a greater number of stillborn pups was noted in both generations at the high dose, with increased post-implantation loss in high dose dams of the second generation. Effects in pups occurred in the absence of maternal toxicity, indicating sensitivity of the young. In a one-generation gavage reproductive toxicity study, reduced pup survival was also noted, but in the presence of maternal toxicity, which included clinical signs and effects on liver and ovarian weights. Pup growth and development was also retarded. No treatment-related malformations occurred in rat, mouse or rabbit developmental studies. Rat dams had decreased body weight, body-weight gain and food consumption, with fetal effects, including delayed ossification, occurring at maternally toxic doses. In a second rat developmental toxicity study, there were increases in pre-implantation loss and rib variations in fetuses at all doses tested, however, the relationship between pre-implantation loss and treatment was considered equivocal at the low and mid-dose as there was no dose relationship. There were no maternal or fetal effects in a mouse developmental study. In rabbit developmental studies, dams showed clinical signs of toxicity, including mortality, body weight loss, decreased body weight-gain and food consumption, as well as liver and stomach effects at doses causing decreased body weight and sex ratio alterations in fetuses.

3.1.1 *Pest Control Products Act* Hazard Characterization

For assessing risks from potential residues in food or from products used in and around homes or schools, the *Pest Control Products Act* requires the application of an additional 10-fold factor to threshold effects to take into account completeness of the data with respect to the exposure of, and toxicity to, infants and children, and potential prenatal and postnatal toxicity. A different factor may be determined to be appropriate on the basis of reliable scientific data.

With respect to the completeness of the toxicity database as it pertains to the toxicity to infants and children, the iodocarb database contains developmental toxicity studies in rats, mice and rabbits and one- and two-generation reproductive toxicity studies in rats.

With respect to potential prenatal and postnatal toxicity, no treatment-related malformations occurred in rat, mouse or rabbit developmental studies. In rat developmental toxicity studies, delayed ossification was noted in fetuses at doses that also caused decreased body weight, body-weight gain and food consumption in maternal animals. In rabbit developmental toxicity studies, decreased fetal body weight and altered sex ratios were noted in the presence of maternal effects that included clinical signs of toxicity, mortality, body weight effects, as well as liver and stomach effects. There was evidence of increased susceptibility of the young in a dietary reproductive toxicity study in rats (two-generation study), while in a gavage reproductive toxicity study (one-generation study), effects in the young were noted in the presence of maternal toxicity. Decreased pup survival and developmental retardation were observed at a dose that was also toxic to the adults. Due to the serious effects (decreased survival, developmental retardation) noted in the young in the presence of maternal toxicity in the gavage rat reproduction toxicity study, the *Pest Control Products Act* factor was retained at 3-fold for scenarios for which this endpoint was used for risk assessment.

3.2 Determination of Acceptable Daily Intake

Not applicable for antisapstain or joinery use.

3.3 Determination of Acute Reference Dose

Not applicable for antisapstain or joinery use.

3.4 Occupational and Non-Occupational Exposure and Risk Assessment

Occupational and non-occupational risk is estimated by comparing potential exposures with the most relevant endpoint from toxicology studies to calculate a margin of exposure (MOE). This is compared to a target MOE incorporating uncertainty factors protective of the most sensitive sub-population. If the calculated MOE is less than the target MOE, it does not necessarily mean that exposure will result in adverse effects, but mitigation measures to reduce risk would be required.

3.4.1 Toxicological Endpoint Selection for Occupational Risk Assessment

Occupational exposure to iodocarb is characterized as intermittent long-term in duration and is predominately by the dermal route.

For long-term dermal:
For long-term dermal exposure, the NOAEL of 10 mg/kg bw/day from the one-generation reproductive toxicity study in rats was selected for use in risk assessment. There were no suitable route specific dermal studies available. The target MOE is 300, which includes uncertainty factors of 10-fold for interspecies extrapolation and 10-fold for intraspecies variability. The concerns outlined in the *Pest Control Products Act* Hazard Characterization section regarding

this endpoint are relevant to the worker population. For this reason, an additional factor of 3-fold was applied to this risk assessment to protect workers of child-bearing age.

Use of this NOAEL and target MOE of 300 provide margins in excess of 600-fold to the LOAEL for thyroid effects in mouse and rat chronic toxicity studies and a margin in excess of 1600-fold to the NOAEL for hepatic tumours in male mice, thus addressing any tumorigenicity concerns.

Table 3.4.1 Toxicology Endpoints for Use in Health Risk Assessment for Iodocarb

Exposure Scenario	Study	Point of Departure and Endpoint	Target MOE
Long-term dermal	One-generation reproductive toxicity study in rats	NOAEL = 10 mg/kg bw/day based on decreased pup survival and developmental retardation in the presence of maternal toxicity	300
Cancer	A threshold approach to the NOAEL for hepatocellular tumours in male mice was used for risk assessment.		

3.4.2 Dermal Absorption

There is no dermal absorption data on file for iodocarb, therefore a dermal absorption value of 100% was used in the risk assessment.

3.4.3 Occupational Exposure and Risk Assessment

Workers can be exposed to the antisapstain chemical iodocarb while treating wood, handling treated wood and during clean-up, maintenance and repair activities.

The Sapstain Industry Group conducted passive dosimetry worker exposure studies to measure the potential exposure of sawmill workers that are exposed to antisapstain chemicals. The complete study was divided into four phases: Phase I identified an appropriate surrogate chemical; Phase II monitored workers to determine job tasks with a potential for exposure to antisapstain chemicals (handling wet treated lumber, handling dry treated lumber, maintenance, clean-up and operating diptanks); Phase III measured workers exposure to those job tasks; and Phase IV measured worker's exposure following the implementation of a Product Stewardship and Exposure Reduction Program (ERP) for the job tasks that demonstrated the highest exposure during Phase III. The workers with the highest potential for exposure included clean-up and maintenance workers and pilers handling freshly treated wood. The ERP also identified areas in sawmills that would benefit from additional mitigation measures to reduce antisapstain chemical exposure, including engineering controls for application systems, instruction on safe handling procedures and proper PPE, and education on the health and safety properties of the antisapstain chemicals. The ERP was shown to reduce exposure for workers handling antisapstain chemicals.

Exposure to workers in a joinery mill is not expected to be underestimated by the Sapstain Industry Group antisapstain exposure study, which measured exposure during treatment by diptank and spraybox systems and while handling treated wood.

3.4.3.1 Occupational Antisapstain and Joinery Exposure and Risk Assessment

Workers can be exposed to iodocarb while treating wood, handling treated wood and during clean-up, maintenance and repair activities. Exposure is expected to be long-term in duration and to occur primarily via the dermal route. Inhalation exposure was demonstrated to be very low for the majority of worker activities in the Phase III of the Sapstain Industry Group study and was not assessed during Phase IV. In addition, a NIOSH-respirator is required during clean-up, maintenance and repairs, or if working in areas that are not well ventilated, in order to reduce potential inhalation exposure as defined in the ERP.

Dermal exposure was estimated by combining the unit exposure values from the surrogate antisapstain worker exposure study with the amount of product handled per day and the dermal absorption value. Exposure was normalized to mg/kg bw/day by using 80 kg adult body weight.

The results of the health risk assessment for sawmill workers exposed to antisapstain or joinery products containing iodocarb are shown below in Table 3.4.3.1. Calculated MOEs exceeded the target MOE and no health risks of concern were identified for sawmill workers wearing the appropriate personal protective equipment as outlined in Appendix III.

Table 3.4.3.1 Iodocarb Exposure Assessment for Sawmill Workers Exposed to Antisapstain and Joinery Products.

Tasks	Unit Exposure (µg/mg/mL)	Max Rate[1] (mg/mL)	Daily Exposure (mg/kg bw/day)	MOE[2]
SIG Phase IV				
Pilers	493.7	5	0.03086	324
Clean-up Crew	203.1	5	0.01269	788
Maintenance Workers	401.4	5	0.02509	399

MOE = Margin of exposure

[1] The maximum treatment solution rates of all iodocarb products is shown as the most conservative scenario.

[2] Dermal MOEs are based on an oral NOAEL of 10 mg/kg bw/day and 100% dermal absorption. Target MOE is 300. MOE = NOAEL/ (Unit Exposure (µg/kg a.i.) * Application Rate / Body Weight (80 kg)).

3.4.4 Postapplication Worker Exposure and Risk Assessment

Postapplication exposure (for wood that has left the sawmill) is not anticipated, as antisapstains are designed to prevent the growth of staining fungi in freshly cut lumber during storage and transit and not for long-term wood protection in residential or commercial areas.

Joinery wood is intended for use in window and door frames and other above ground non-structural decorative exterior wood such as soffits and fascia. Additionally, joinery wood is often painted or covered with vinyl or aluminium or other material prior to being sold in the market. Significant human post-application exposure is not expected for this type of wood.

Furthermore, no health risks of concern were identified for workers handling freshly treated wood (wet or dry) in the sawmill whose exposure is expected to be greater than for workers handling of treated wood or joinery products after it has left the sawmill.

3.4.5 Non-Occupational Exposure and Risk Assessment

Non-occupational or residential risk assessment involves estimating risks to the general population, including children and youths, during or after pesticide application. There are no registered domestic class antisapstain or joinery products for iodocarb. Residential exposure to individuals contacting wood treated with iodocarb for antisapstain or joinery uses is not expected to result in health risks of concern.

3.4.6 Bystander Exposure

Bystander exposure is not anticipated, as iodocarb containing antisapstain products are designed to prevent the growth of staining fungi in freshly cut lumber during storage and transit and not for long-term wood protection in residential or commercial areas.

Joinery wood is intended for use in window and door frames and other above ground non-structural decorative exterior wood such as soffits and fascia. Additionally, joinery wood is often painted or covered with vinyl or aluminium or other material prior to being sold in the market. Significant human exposure is not expected for this type of wood.

Furthermore, no health risks of concern were identified for workers handling freshly treated wood (wet or dry) in the sawmill whose exposure is expected to be greater than for bystanders handling treated wood or joinery products after it has left the sawmill.

Therefore, health risks to bystanders are not of concern.

3.5 Incident Reports Related to Health

Since April 2007, registrants have been required by law to report incidents to the PMRA that include adverse effects to Canadian health or the environment. As of 25 November 2016, no human or domestic animal incidents involving the active ingredient iodocarb were reported to the PMRA. The USEPA incident reporting program mentions "Twenty-seven human incidents associated with IPBC exposure have been reported in the OPP incident database. Both local skin irritation and systemic effects were reported in these incidents. Skin irritation and skin sensitization-like symptoms were the primary effects, including rash, swelling, itching, burning and/or tingling sensation, blister, erythema/flushing, and hives. In some cases, chest tightness and respiratory problems were reported. Other reported systemic effects include nausea/vomiting, headache, fatigue, vertigo, and fever."

Appropriate hazard statements regarding potential skin or eye effects appear on current Canadian product labels for iodocarb containing products.

These incident reports were considered in this evaluation and did not affect the risk assessment. No label changes resulting from these incident reports are considered necessary at this time.

3.6 Cumulative Assessment

Cumulative assessment takes into consideration non-occupational exposures (exposure via dietary, drinking water and residential use) to multiple pesticides that share a common mechanism of toxicity. As there are no domestic class registrations for iodocarb as an antisapstain, and residential exposure to joinery-type products is anticipated to be minimal, a cumulative assessment is not required for these uses.

4.0 Impact on the Environment

Treated wood joinery products are not subject to significant leaching. The treated window frames and doors are either clad with protective aluminium or vinyl, or are top coated with paint or varnish. The finished windows and doors are installed above-ground in buildings that are generally designed to minimize contact with rain. Any leaching of joinery preservative that does occur, should be limited to the area around the building in which they were installed. Therefore, due to limited environmental exposure, no quantitative environmental risk assessment was conducted for the joinery uses of iodocarb. Furthermore, as most joinery active ingredients are also antisapstain active ingredients, the environmental risk assessment for the antisapstain use of iodocarb would be expected to cover any environmental risks posed by joinery products.

4.1 Fate and Behaviour in the Environment

Through its use as an antisapstain, iodocarb may enter the environment when it leaches from treated wood that has come in contact with water.

Iodocarb is non-persistent in soil and water as indicated by DT_{50} values of less than 3 hours in aerobic mineral soils and less than 14 hours in anaerobic water-sediment systems. Iodocarb hydrolyses rapidly at alkaline pHs ($t_{1/2}$= 0.947 d at pH 9) but is more stable to hydrolysis at neutral and acidic pHs ($t_{1/2}$= 139 d at pH 7, stable at pH 5). Iodocarb is very soluble in water and, based on Freundlich adsorption coefficients, is expected to be mobile in mineral soils. However, based on the rapid transformation of iodocarb in soil and water, it is not expected to enter groundwater or surface water.

In soil and water, iodocarb transforms to propargyl butyl carbamate. Like the parent, propargyl butyl carbamate is also non-persistent in soil and water as indicated by DT_{50} values of 4.31 days in soil and 11.5 days in an anaerobic water-sediment system. In anaerobic aquatic environments, propargyl butyl carbamate transformed to 2-propenyl-butylcarbamate (2-PBC) and minor unidentified transformation products. No mobility data were available for transformation products of iodocarb.

Volatilization and subsequent phototransformation of iodocarb in air is unlikely to be a major route of dissipation due to its intermediate to low vapour pressure. Bioaccumulation of iodocarb is not expected to be a concern in animal tissues as its log K_{ow} value of 2.3–2.88 indicates it has limited potential for bioaccumulation.

Information regarding the physicochemical properties of iodocarb is presented in Appendix II, Table 1. Data on the fate and behaviour of iodocarb in the environment are presented in Appendix II, Table 2.

4.2 Environmental Risk Characterization

The environmental risk assessment integrates the environmental exposure and ecotoxicology information to estimate the potential for adverse effects on non-target species. This integration is achieved by comparing exposure concentrations with concentrations at which adverse effects occur. Estimated environmental concentrations (EECs) are concentrations of pesticide in various environmental media, such as food, water, soil and air. The EECs are estimated using standard models which take into consideration the application rate(s), chemical properties and environmental fate properties, including the dissipation of the pesticide between applications.

Environmental exposure from chemicals used to treat wood may result from two scenarios, runoff from wood treatment facilities to adjacent waterbodies and direct leaching from wood in-use to water or soil. Antisapstain products are designed for short-term protection of wood, primarily during its storage and transit, and for wood that is not expected to be in direct contact with soil or water during its use, such as in construction of above-ground components of various structures. Therefore, only an assessment of the potential environmental exposure from treatment facilities was considered to be relevant for antisapstain products.

At wood treatment facilities using antisapstain products, these chemicals may enter the environment when freshly treated wood is exposed to precipitation (primarily rainwater). Although the wood treatment process itself generally occurs in enclosed areas, immediately after the treatment the wood needs to sit for a short period of time to allow excess treatment solution to drip off and for the wood to dry. This initial drying process is to take place outside on a drip pad that is roofed and paved. This minimizes the exposure of the treated wood to rain, while the paved surface aids in containing the drippings from the wood and channeling any excess chemicals to the appropriate receptacles for recycling or disposal. However, once the treated wood is dry, it is stored at the treatment facility until shipment to retailers and may be exposed to rain. Therefore, there is a potential that when used as an antisapstain, iodocarb may enter the environment through leaching from the treated wood during storage at wood treatment facilities.

Exposure of terrestrial organisms to iodocarb within the vicinity of these storage areas is expected to be negligible. Therefore, the risk to terrestrial organisms was not considered further in the risk assessment. Exposure to aquatic habitats is possible if iodocarb leaches from stored, treated wood at treatment facilities and runs-off to adjacent waterbodies.

The EECs of iodocarb resulting from this use are based on selected exposure scenarios (Appendix II, Table 4), developed from the OECD Revised Emission Scenario Document for Wood Preservatives. Scenario selection was based on the following considerations:

- Iodocarb is to be applied only by dipping (including immersion) or automated spraying (large plant / small plant) at treatment facilities.

- As iodocarb is not expected to volatilize, EECs in air are expected to be negligible. EECs for this compartment are not required.
- Exposure of non-target organisms in the terrestrial environment is expected to be minimal.
- Environmental exposure to these products when the wood is in use is expected to be limited.
- Treatment facilities, including the drip pad for initial drying of treated wood, consist mostly of paved and roofed areas, except for longer-term storage, so leaching of iodocarb from treated wood to soil is expected to be limited to in and around the facilities.
- Iodocarb may enter the aquatic environment through leaching from treated wood stored at treatment facilities followed by run-off to nearby waterbodies (either freshwater or marine).

4.2.1 Risks to Aquatic Organisms

The exposure scenario for freshwater and estuarine organisms considers surface run-off into adjacent waterbodies from treatment plants using automated spraying (small plant, scenario 1; large plant, scenario 2) and dipping (scenario 3) product application methods. Conservative scenarios assumed that the storage areas were uncovered and unprotected, 100% of the pesticide leached during the storage period, and that 50% of the rainwater ran directly into an adjacent surface water body. Further details for all exposure scenarios are presented in Appendix II, Table 4.

For the OECD scenarios, EECs are derived from the specific scenario parameters identified in Table 4 of Appendix II in combination with the deposition rate of the chemical as stated on the label (Appendix II, Table 5). For each scenario, EECs are calculated on a daily basis and consider that 100% of the pesticide leaches during the storage period.

Ecotoxicology information includes acute toxicity data for freshwater and marine fish and invertebrates. A summary of the available aquatic toxicity data for iodocarb is presented in Appendix II, Table 3. Aquatic toxicity values used for this assessment are summarized in Appendix II, Table 6.

For characterizing acute risk, acute toxicity values (for example LC_{50} and EC_{50}) are multiplied by an uncertainty factor. The uncertainty factor is used to account for differences in inter- and intra-species sensitivity as well as varying protection goals (for example community, population, individual). Thus, the magnitude of the uncertainty factor depends on the group of organisms that are being evaluated (for example 0.1 for fish, 0.5 for aquatic invertebrates). When assessing chronic risk, the NOEC or NOEL is used and an uncertainty factor is not applied.

A risk quotient (RQ) is calculated by dividing the exposure estimate by an appropriate toxicity value (RQ = exposure/toxicity), and the RQ is then compared to the level of concern (LOC). If the screening level RQ is below the LOC (LOC=1 for aquatic organisms), the risk is considered negligible and no further risk characterization is necessary. If the screening level RQ is equal to or greater than the LOC, then further characterization of the risk is required. Calculated EECs and RQs for freshwater and marine organisms are located in Appendix II, Table 6.

Freshwater Invertebrates: The risk quotient values for acute toxicity to freshwater invertebrates did not exceed the LOC for surface runoff from any treatment facility. The use of iodocarb as an antisapstain is not expected to pose an acute risk to freshwater invertebrates.

Freshwater Fish and Amphibians: The risk quotient values for acute toxicity to freshwater fish did not exceed the LOC for surface runoff from a small spray treatment facility. The risk quotient value did, however, exceed the LOC when considering acute exposure to runoff from a large spray treatment facility (RQ = 8.5) or a dip treatment facility (RQ = 1.6). The acute risk to the aquatic life stages of amphibians was assessed based on the generic freshwater environment scenarios, using the most sensitive fish toxicity value as a surrogate endpoint (i.e. based on the rainbow trout acute toxicity study). The risk quotient value for acute exposure of amphibians to iodocarb exceeded the LOC when considering acute exposure to runoff from a large treatment facility (RQ = 8.5) or a dip treatment facility (RQ = 1.6).

Marine Invertebrates: The risk quotient values for acute toxicity to marine invertebrates did not exceed the LOC for surface runoff from either a small spray treatment facility or a dip treatment facility. The risk quotient value did, however, exceed the LOC when considering acute exposure to runoff from a large spray treatment facility (RQ = 4.1).

Marine Fish: The risk quotient values for acute toxicity to marine fish did not exceed the LOC for surface runoff from either a small spray treatment facility or a dip treatment facility. The risk quotient value did, however, exceed the LOC when considering acute exposure to runoff from a large spray treatment facility (RQ = 3.2).

The results indicate a potential for acute risk to freshwater fish and amphibians, and potential acute risk to marine invertebrates and fish. Risk quotients for effects of runoff to freshwater and marine organisms were slightly above the level of concern, ranging from 1.6 to 8.5 (freshwater fish).

The risk assessment includes several conservative assumptions. The estimated exposure concentrations were calculated assuming all of the iodocarb, present in/on stored lumber, leaches out of the wood within a relatively short period of time. In addition, the risk assessment assumes that 50% of the iodocarb leached will reach the aquatic environment following an average rain pattern. Given these conservative assumptions, the risk to aquatic organisms is expected to be less under more typical conditions. Mitigation measures are required (Appendix III) to reduce or prevent runoff of iodocarb from wood treatment facilities to aquatic habitats.

Given the conservative nature of the assessment and the small exceedances of the LOC, when the mitigation measures outlined on the label to reduce the ability of iodocarb to run-off from treatment facilities to aquatic habitats are followed, the use of iodocarb as an antisapstain is not expected to pose a risk of concern to the environment.

4.2.2 Overall Summary

When used as an antisapstain according to the revised label directions, iodocarb is not expected to pose risks of concern to the environment. Iodocarb has the potential to leach from wood at treatment facilities and subsequently run-off to aquatic environments. Mitigation measures

include directions to prevent surface runoff water from wood freshly treated with iodocarb from reaching aquatic systems as well as the use of precautionary label statements identifying environmental hazards on the product labels (Appendix III).

4.2.3 Incident Reports Related to the Environment

There were no environmental incidents involving iodocarb in the PMRA database as of 25 November 2016. A review of US incidents in the EIIS database (1992 to 2015) was also conducted, and no environment incidents involving iodocarb were found.

5.0 Value

Antisapstains

Iodocarb has value as one of several antisapstain active ingredients for controlling sapstain. The current active ingredients have replaced older antisapstain chemistries based on chlorophenates, which were phased-out in the 1980's for this use due to health and environmental concerns.

The application rates of antisapstain products are expressed both as treatment solution concentrations (%) and as the deposition rate in the treated wood (for example, µg a.i. per cm^2 wood). They are applied to freshly-cut wood in saw mills by dipping or spraying to achieve a short-term protection of several months. An alternative to antisapstain treatment is kiln-drying of the wood. However, some freshly cut lumber may still require antisapstain treatment while it is stored prior to kiln drying.

Joinery

Iodocarb has value as one of several joinery active ingredients to protect millwork. The current active ingredients have replaced older joinery chemistries based on tributyltin and organic mercury-based products, which were discontinued in the 1990s due to health and environmental concerns. Joinery products are typically applied by dip and spray, but may also be applied to wood with flood coating or double vacuum treatment. The application rates of joinery products are expressed as treatment solution concentrations (%) and as either a deposition rate (µg a.i. per cm^2 wood surface) or a retention rate (kg a.i. per m^3 wood volume) in the treated wood.

6.0 Pest Control Product Policy Considerations

6.1 Toxic Substances Management Policy Considerations

The Toxic Substances Management Policy (TSMP) is a federal government policy developed to provide direction on the management of substances of concern that are released into the environment. The TSMP calls for the virtual elimination of Track 1 substances [those that meet all four criteria outlined in the policy: persistent (in air, soil, water and/or sediment), bio-accumulative, primarily a result of human activity and toxic as defined by the *Canadian Environmental Protection Act*].

During the review process, iodocarb and its transformation product, propargyl butyl carbamate, were assessed in accordance with the PMRA Regulatory Directive DIR99-03[4] and evaluated against the Track 1 criteria. The PMRA has reached the following conclusions:

- Iodocarb does not meet TSMP Track 1 criteria, and is not considered a TSMP Track 1 substance. See Table 7 of Appendix II for comparison with Track 1 criteria.
- Propargyl butyl carbamate (PBC) does not meet TSMP Track 1 criteria, and is not considered a TSMP Track 1 substance. See Appendix II, Table 7 for comparison with Track 1 criteria.

6.2 Formulants and Contaminants of Health or Environmental Concern

During the review process, contaminants in the technical and formulants and contaminants in the end-use products are compared against the *List of Pest control Product Formulants and Contaminants of Health or Environmental Concern* maintained in the *Canada Gazette*.[5] The list is used as described in the PMRA Notice of Intent NOI2005-01[6] and is based on existing policies and regulations including: DIR99-03; and DIR2006-02,[7] and taking into consideration the Ozone-depleting Substance Regulations, 1998, of the *Canadian Environmental Protection Act* (substances designated under the Montreal Protocol). The PMRA has reached the following conclusions:

- Iodocarb does not contain any contaminants of health or environmental concern identified in the *Canada Gazette*.
- The end-use products Troysan Polyphase AF-1, NP-1 Sapstain Control Chemical, NP-2 Sapstain Control Chemical, Omacide IPBC 30 Industrial Fungicide, Omacide IPBC 100 Industrial Fungicide, Omacide IPBC 40 Industrial Fungicide, Wolman I, and Polyphase P-20TEP do not contain any formulants or contaminants of health or environmental concern identified in the *Canada Gazette*.

The use of formulants in registered pest control products is assessed on an ongoing basis through PMRA formulant initiatives and Regulatory Directive DIR2006-02.

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4 DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*

5 *Canada Gazette*, Part II, Volume 139, Number 24, SI/2005-114 (2005-11-30) pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* and in the order amending this list in the *Canada Gazette*, Part II, Volume 142, Number 13, SI/2008-67 (2008-06-25) pages 1611-1613. *Part 1 Formulants of Health or Environmental Concern, Part 2 Formulants of Health or Environmental Concern that are Allergens Known to Cause Anaphylactic-Type Reactions and Part 3 Contaminants of Health or Environmental Concern.*

6 NOI2005-01, *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern under the New Pest Control Products Act.*

7 DIR2006-02, *Formulants Policy and Implementation Guidance Document.*

7.0 Proposed Re-evaluation Decision

The PMRA is proposing that antisapstain and joinery uses of products containing iodocarb are acceptable for continued registration with additional risk-reduction measures to protect human health and the environment. The proposed mitigation measures are presented in Appendix III. No additional data are being requested at this time.

List of Abbreviations

a.i.	active ingredient
AChE	acetyl linesterase
BAF	bioaccumulation factor
BCF	bioconcentration factor
BMDL	benchmark dose level
d	day(s)
DT50	dissipation time 50% (the time required to observe a 50% decline in concentration)
CEPA	*Canadian Environmental Protection Act*
bw	body weight
DDAC	didecyldimethylammonium chloride
cm	centimetre(s)
EAD	Environmental Assessment Directorate
EC_{50}	effective concentration on 50% of the population
ECHA	European Chemical Agency
EEC	estimated environmental concentration
ERP	Exposure Reduction Program
g	gram(s)
h	hour(s)
HECSB	Healthy Environments and Consumer Safety Branch
i.e.	*id est*
IPBC	iodocarb
kg	kilogram(s)
L	litre(s)
LC_{50}	lethal concentration 50%
LD_{50}	lethal dose 50%
LOAEL	lowest observed adverse effect level
LOC	level of concern
Log K_{ow}	octanol/water partition coefficient
m	meter(s)
mg	milligram(s)
mL	millilitre(s)
mm Hg	millimetre(s) of mercury
MOE	margin of exposure
mPa	millipascal
NIOSH	National Institute for Occupational Safety and Health
N/A	not applicable
NOAEL	no observable adverse effect level

NOEC	no observed effect concentration
NOEL	no observed effect level
OECD	Organization for Economic Cooperation and Development
PMRA	Pest Management Regulatory Agency
PPE	personal protective equipment
PRVD	Proposed Re-evaluation Decision
s	second
RQ	risk quotient
SIG	Sapstain Industry Group
TCMTB	2-(thiocyanomethylthio) benzothiazole
TGAI	Technical Grade of the Active Ingredient
TSMP	Toxic Substances Management Policy
UV	ultraviolet
µg	microgram(s)
µL	microlitre

Appendix I

Table 1 Antisapstain Iodocarb Products Currently Registered

Active	Technical Grade Active Ingredient Sources		End-Use Products	
	Registration Number	Product Name	Registration Number	Product Name
Iodocarb	21750	Polyphase P100	21751	Polyphase AF-1
			26985 (with DDAC)	NP-2 Sapstain Control Chemical
			21753 (with DDAC)	NP-1 Sapstain Control Chemical
	28422	Omacide (R) IPBC 100 Technical Powder Fungicide	29419	Omacide IPBC 30 Industrial Fungicide
			29420	Omacide IPBC 100 Industrial Fungicide
			29421	Omacide IPBC 40 Industrial Fungicide
	29420	Omacide IPBC 100 Industrial Fungicide	31256	Wolman I
	24141	Polyphase P-20T	31675	Polyphase P-20TEP

Table 2 Joinery Iodocarb Products Currently Registered

Active	Technical Grade Active Ingredient Sources		End-Use Products	
	Registration Number	Product Name	Registration Number	Product Name
Iodocarb	21750	Polyphase P100	21751	Polyphase AF-1
			25696	Woodlife F Clear Wood Preservative
	24141	Polyphase P-20T	30584 (with propiconazole and tebuconazole)	Woodlife 111 Water Repellent Wood Preservative
			27252	Timbertreat C Broad Spectrum Fungicide
			31675	Polyphase P-20TEP
	28422	Omacide (R) IPBC 100 Technical Powder Fungicide	29419	Omacide IPBC 30 Industrial Fungicide
			29420	Omacide IPBC 100 Industrial Fungicide
			29421	Omacide IPBC 40 Industrial Fungicide
		Omacide IPBC 100 Industrial Fungicide	31256 (repack of 29420)	Wolman I

Appendix II

Table 1 Summary of physicochemical properties of iodocarb

Compound	Type of the study	Value	Comments
Iodocarb	Solubility	146 – 174 mg/L	Very soluble in water
Iodocarb	Ultraviolet (UV)/visible spectrum	NA	Not expected to absorb at $\lambda > 300$ nm
Iodocarb	Vapour Pressure	$0.1 - 3.8 \times 10^{-3}$ Pa	Intermediate to low volatility
Iodocarb	Octanol-Water Partition Coefficient, log K_{ow}	log $K_{ow} = 2.3 - 2.88$	Bioaccumulation is unlikely

NA = not available

Table 2 Fate and Behaviour of Iodocarb and Propargyl butyl carbamate in the Environment

Property	Test substance	Value	Transformation products	Comments	Reference
Abiotic transformation					
Hydrolysis	Iodocarb (radiolabeled)	pH 9: $t_{1/2} = 0.947$ d pH 7: $t_{1/2} = 139$ pH 5: stable	Propargyl butyl carbamate (PBC)	Iodocarb hydrolyses rapidly at alkaline pHs but is stable to hydrolysis at acidic pHs.	PMRA #1315023
Biotransformation					
Biotransformation in aerobic soil	Iodocarb (radiolabeled)	Blackoar loam soil (22°C) DT_{50}: 2.13 h	Propargyl butyl carbamate (PBC)	Iodocarb is non-persistent in aerobic soil.	PMRA #1315023
Biotransformation in aerobic soil	Propargyl butyl carbamate (PBC)	Blackoar loam soil (22°C) DT_{50}: 4.31 d	CO_2, bound soil residues, and an unidentified metabolite	PBC is non-persistent in aerobic soil.	PMRA #1315023
Biotransformation in anaerobic water-sediment system	Iodocarb (radiolabeled)	Water-sediment system (22°C) DT_{50}: 1.5 h	Primary: Propargyl butyl carbamate (PBC)	Iodocarb is non-persistent in anaerobic water-sediment systems.	PMRA #1315023
Biotransformation in anaerobic water-sediment system	Iodocarb (radiolabeled)	Water-sediment system DT_{50}: 13.3 h (sterile)	Primary: Propargyl butyl carbamate (PBC)	Iodocarb is non-persistent in anaerobic water-sediment systems.	PMRA #1315023

Property	Test substance	Value	Transformation products	Comments	Reference
Biotransformation in anaerobic water-sediment system	Propargyl butyl carbamate (PBC)	Water-sediment system DT_{50}: 11.5 d	2-propenyl-butylcarbamate (2-PBC), two unidentified compounds, CO_2, possibly CH_4	PBC is non-persistent in anaerobic water-sediment systems.	PMRA #1315023
Mobility					
Adsorption / desorption in soil	Iodocarb (radiolabeled)	Five soils: Freundlich adsorption coefficients: 0.67 – 2.46 ml/g Freudlich desorption coefficients: 3.4 – 31 ml/g	Propargyl butyl carbamate (PBC)	Iodocarb is expected to be mobile to very mobile in mineral soils. Adsorption was not correlated to organic matter content, clay content or cation exchange capacity of soil.	PMRA #1315023

Table 3 Toxicity of Iodocarb to Non-Target Aquatic Species

Organism	Exposure	Test substance	Endpoint value	Degree of toxicity[1]	Reference
Freshwater species					
Daphnia magna	Acute	Iodocarb	EC_{50} = 0.956 mg a.i./L	Highly toxic	PMRA #1315023
Daphnia magna	Acute	Iodocarb	EC_{50} = 0.16 mg a.i./L	Highly toxic	PMRA #1315023
Rainbow trout, *Oncorhynchus mykiss*	96h-Acute	Iodocarb	LC_{50} = 0.072 mg a.i./L	Very highly toxic	PMRA #1315023
Rainbow trout, *Oncorhynchus mykiss*	96h-Acute	Iodocarb	LC_{50} = 0.067 mg a.i./L	Very highly toxic	PMRA #1315023
Bluegill sunfish, *Lepomis macrochirus*	96h-Acute	Iodocarb	LC_{50}= 0.226 mg a.i./L	Highly toxic	PMRA #1315023
Fathead Minnow, *Pimephales promelas*	96h-Acute	Iodocarb	LC_{50}= 0.2 mg a.i./L	Highly toxic	PMRA #1315023
Marine species					
Pink shrimp, *Pandalus borealis*	Acute	Iodocarb	EC_{50}= 0.103 mg a.i./L	Highly toxic	PMRA #1315023
Sheepshead minnow, *Cyprinodon variegatus*	Acute	Iodocarb	EC_{50}= 0.18 mg a.i./L	Highly toxic	PMRA #1315023
Eastern oyster, *Crassostrea virginica* (shell deposition)	Acute	Iodocarb	EC_{50}= 0.028 mg a.i./L	Very highly toxic	PMRA #1315023

[1] USEPA classification

Table 4 Scenarios considered for the risk assessment

Scenario	Description	Details	
Scenario for industrial preventive treatment			
	Runoff from storage of treated wood		
1	***Automated spraying (small plant)***	Surface area of the storage place:	79 m^2
		Exposed surface of wood:	11 m^2/m^2
		Duration of storage:	3 d
		Rain fraction reaching water:	0.5
		Flow rate of creek/river:	0.3 m^3s^{-1}
2	***Automated spraying (large plant)***	Surface area of the storage place:	790 m^2
		Exposed surface of wood:	11 m^2/m^2
		Duration of storage:	3 d
		Rain fraction reaching water:	0.5
		Flow rate of creek/river:	0.3 m^3s^{-1}
3	***Dipping/Immersion***	Surface area of the storage place:	700 m^2
		Exposed surface of wood:	11 m^2/m^2
		Duration of storage:	14 d
		Rain fraction reaching water:	0.5
		Flow rate of creek/river:	0.3 m^3s^{-1}

Table 5 Amount of Iodocarb leached from freshly treated wood

Scenario	Deposition rate (µg/m^2)[a]	Surface area of the storage place (m^2)	Exposed surface of wood (m^2/m^2)	Storage Period (d)	Amount of iodocarb leached (kg/d)[b,c]
Automated spraying (small plant)	510 000	79	11	3	0.15
Automated spraying (large plant)	510 000	790	11	3	1.48
Dipping/Immersion	510 000	700	11	14	0.28

[a]Highest deposition rate of iodocarb from all antisapstain products currently registered by the PMRA and confirmed by VRD.
[b]Amount of iodocarb leached = Deposition rate * Surface area of the storage place * Exposed surface of wood / Storage period.
[c]Emissions from a storage facility are considered stable over time and assume that 100% of the pesticide leaches during the storage period.

Table 6 Expected environmental concentrations (EECs) and risk quotients (RQs) for freshwater and marine organisms based on storage of treated wood (surface runoff from treatment facilities).

Organism	Species Uncertainty Factor	Endpoint[1]	1-d EEC[2] (mg a.i./L)	RQ[3]
Storage after automated spraying (small plant)				
Freshwater organisms				
Daphnia magna	1/2	EC_{50} = 0.08 mg a.i /L	0.0057	0.071
Rainbow trout	1/10	96-h LC_{50} = 0.0067 mg a.i /L	0.0057	0.851
Marine organism				
Pink shrimp	1/2	96-h LC_{50} = 0.0515 mg a.i /L	0.0057	0.111

Sheepshead minnow	1/10	EC_{50}	= 0.018	mg a.i./L	0.0057	0.317
Eastern oyster (shell deposition)	1/2	EC_{50}	= 0.014	mg a.i./L	0.0057	0.407
Storage after automated spraying (large plant)						
Freshwater organisms						
Daphnia magna	1/2	EC_{50}	= 0.08	mg a.i./L	0.0570	0.712
Rainbow trout	1/10	96-h LC_{50}	= 0.0067	mg a.i./L	0.0570	**8.507**
Marine organism						
Pink shrimp	1/2	96-h LC_{50}	= 0.0515	mg a.i./L	0.0570	**1.107**
Sheepshead minnow	1/10	EC_{50}	= 0.018	mg a.i./L	0.0570	**3.166**
Eastern oyster (shell deposition)	1/2	EC_{50}	= 0.014	mg a.i./L	0.0570	**4.071**
Storage after dip/immersion						
Freshwater organisms						
Daphnia magna	1/2	EC_{50}	= 0.08	mg a.i./L	0.0156	0.135
Rainbow trout	1/10	96-h LC_{50}	= 0.0067	mg a.i./L	0.0156	**1.615**
Marine organism						
Pink shrimp	1/2	96-h LC_{50}	= 0.0515	mg a.i./L	0.0156	0.210
Sheepshead minnow	1/10	EC_{50}	= 0.018	mg a.i./L	0.0156	0.601
Eastern oyster (shell deposition)	1/2	EC_{50}	= 0.014	mg a.i./L	0.0156	0.773

[1]Endpoints used in the acute exposure risk assessment are derived by multiplying the EC_{50} or LC_{50} from the appropriate laboratory study by the species uncertainty factor.

[2]Expected Environmental Concentration (EEC) = amount of iodocarb leached per day (Table 4) / flow rate of a creek or river (Table 3). EECs are calculated on a per day basis.

[3]Risk Quotient (RQ) = exposure/toxicity. RQ > 1 (in bold) indicates exceedance of LOC (Level Of Concern).

Table 7 Toxic Substances Management Policy Considerations-Comparison to TSMP Track 1 Criteria

TSMP Track 1 Criteria	TSMP Track 1 Criterion value		Iodocarb	Propargyl butyl carbamate
CEPA toxic or CEPA toxic equivalent[1]	Yes		Yes	Yes
Predominantly anthropogenic[2]	Yes		Yes	Yes
Persistence[3]:	Soil	Half-life ≥ 182 days	Half-life = 2.13 h	Half-life = 4.31 d
	Water	Half-life ≥ 182 days	Half-life = 1.5 – 13.3 h in anaerobic water-sediment test system	Half-life = 11.5 d in anaerobic water-sediment test system
	Sediment	Half-life ≥ 365 days	Half-life = 1.5 h (non-sterile) to 13.3 h (sterile) in water-sediment test system	Half-life = 11.5 d in water-sediment test system
	Air	Half-life ≥ 2 days or evidence of long range transport	Iodocarb has intermediate to low volatility. (Vapour pressure = $0.1 – 3.8 \times 10^{-3}$ Pa)	Not available
Bioaccumulation[4]	Log K_{OW} ≥ 5		2.3 – 2.88	Not available
	BCF ≥ 5000		Not available	Not available
	BAF ≥ 5000		Not available	Not available
Is the chemical a TSMP Track 1 substance (all four criteria must be met)?			No, does not meet TSMP Track 1 criteria.	No, does not meet TSMP Track 1 criteria.

[1] All pesticides will be considered CEPA-toxic or CEPA toxic equivalent for the purpose of initially assessing a pesticide against the TSMP criteria. Assessment of the CEPA toxicity criteria may be refined if required (i.e. all other TSMP criteria are met).

[2] The policy considers a substance "predominantly anthropogenic" if, based on expert judgement, its concentration in the environment medium is largely due to human activity, rather than to natural sources or releases.

[3] If the pesticide and/or the transformation product(s) meet one persistence criterion identified for one media (soil, water, sediment or air) than the criterion for persistence is considered to be met.

[4] Field data (e.g. BAFs) are preferred over laboratory data (e.g. BCFs) which, in turn, are preferred over chemical properties (for example, log K_{ow}).

Appendix III Label Statements Proposed for Antisapstain and Joinery Products containing Iodocarb

The label amendments proposed below do not include all label requirements for individual products, such as first aid statements, disposal statements, precautionary statements and protective equipment. Information on labels of currently registered products should not be removed unless it contradicts the following label statements.

PROPOSED STATEMENTS TO PROTECT HUMAN HEALTH

To protect workers, additional personal protective equipment is required on all iodocarb antisapstain and joinery product labels. In order to conform to the ERP, the following statements are proposed to be included on the appropriate product labels in a section entitled **PRECAUTIONS**:

Antisapstain Product Labels

- Wear chemical-resistant coveralls over long-sleeved shirt and long pants, chemical-resistant gloves, goggles or face shield, socks, and chemical-resistant footwear when handling the concentrate or during mixing/loading, application, clean-up, maintenance and repair activities.
- Use a NIOSH-respirator if the area is not well ventilated.
- Use a NIOSH-respirator during clean-up, maintenance and repair activities.
- When piling freshly treated lumber or if there is a potential for getting wet by the treating solution or by handling freshly treated lumber, wear chemical-resistant coveralls or a chemical-resistant apron over long-sleeved shirt and long pants, chemical-resistant gloves, socks and chemical-resistant footwear.
- When working in the dip or spray area, wear long-sleeved shirt, long pants, chemical-resistant gloves, socks and boots. Wear goggles or face shield if there is a possibility of splashing.
- Once dry, the treated wood can be handled with cotton or leather gloves.
- Wash hands and face before eating, drinking, smoking and using the toilet. Change clothes daily. Wash contaminated clothing separately from household laundry. Not for use or storage in or around the home. Clean contaminated equipment thoroughly prior to making welding repairs.

Joinery Product Labels:

- Wear chemical-resistant coveralls over long-sleeved shirt and long pants, chemical-resistant gloves, goggles or face shield, socks, and chemical-resistant footwear when handling the concentrate or during mixing/loading, application, clean-up, maintenance and repair activities.
- Use a NIOSH-respirator if the area is not well ventilated.
- Use a NIOSH-respirator during clean-up, maintenance and repair activities and when opening pressure treatment cylinder doors.

- When handling freshly treated wood or if there is a potential for getting wet by the treating solution, wear chemical-resistant coveralls or a chemical-resistant apron over long-sleeved shirt and long pants, chemical-resistant gloves, socks and chemical-resistant footwear.
- When working in the application area, wear long-sleeved shirt, long pants, chemical-resistant gloves, socks and boots. Wear goggles or face shield if there is a possibility of splashing.
- Once dry, the treated wood can be handled with cotton or leather gloves.
- Wash hands and face before eating, drinking, smoking and using the toilet. Change clothes daily. Wash contaminated clothing separately from household laundry. Not for use or storage in or around the home. Clean contaminated equipment thoroughly prior to making welding repairs.

Additional label amendments for Polyphase AF-1:
A deposition rate (34-51 $\mu g/cm^2$) must be added to the Polyphase AF-1 label to be consistent with all the other antisaptain products containing iodocarb as the sole active ingredient. Furthermore, the treatment concentration must be reduced to 0.30% to also be consistent with all the other registered products.

PROPOSED ENVIRONMENTAL STATEMENTS

A. Environmental Label statements proposed for TGAIs: Polyphase P-20T, Polyphase P100, Omacide® IPBC 100 Technical Powder Fungicide

I) **ENVIRONMENTAL PRECAUTIONS**:

TOXIC to aquatic organisms.

DO NOT discharge effluent containing this product into sewer systems, lakes, streams, ponds, estuaries, oceans or other waters.

II) **DISPOSAL**:

Canadian manufacturers should dispose of unwanted active ingredients and containers in accordance with municipal or provincial regulations. For additional details and clean-up of spills, contact the manufacturer or the provincial regulatory agency.

B. Label statements proposed for End Use Products:

I) **ENVIRONMENTAL PRECAUTIONS**:

TOXIC to aquatic organisms.

II) **DIRECTION FOR USE**:

DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

This product is TOXIC to aquatic organisms. It is not to be used in circumstances that would cause or allow it to enter lakes, streams, ponds, estuaries, oceans or other waters in contravention of federal or provincial regulatory requirements. The requirements of applicable laws should be determined before using the product.

Dip tanks and drip aprons must be roofed, paved and drained to prevent dilution and loss of treatment solution.

Store treated lumber on a roofed drip pad until dripping has ceased. Slope lumber on the drip pad to expedite drainage and to ensure that no puddles remain on the surface of the wood. Manage drippage and other related wastes to prevent release in the environment.

DO NOT expose treated lumber to rains immediately after treatment.

For further information on storage, handling, and disposal of treated wood, contact the manufacturer of this product or the provincial regulatory agency.

III) **STORAGE**:

To prevent contamination store this product away from food or feed.

IV) **DISPOSAL**:

DO NOT reuse this container for any other purpose. This is a recyclable container, and is to be disposed of at a container collection site. Contact your local distributor/dealer or municipality for the location of the nearest collection site. Before taking the container to the collection site:

1. Triple- or pressure-rinse the empty container. Dispose of the rinsings in accordance with provincial requirements.

2. Make the empty, rinsed container unsuitable for further use.

   If there is no container collection site in your area, dispose of the container in accordance with provincial requirements.

   For information on disposal of unused, unwanted product, or in the case of a spill or spill clean-up, contact the manufacturer or the provincial regulatory agency.

References

A. LIST OF STUDIES/INFORMATION SUBMITTED BY REGISTRANT

Human Health

PMRA #	Reference
1665704	2008, Final Report: Field Monitoring and Re-evaluation of Workers Dermal Exposures to Didecyldimethylammonium Chloride (DDAC) Used in the Protection of Cut Lumber, DACO: 5.4
1142745	1991, 91-day dermal toxicity study in rats with Troysan Polyphase P-100 final report (3228.14), DACO: 4.3.4
1145649, 1143360, 1143363, 1143365, 1143367	1992, Range-finding teratology study in rabbits with Troysan Polyphase P-100, DACO:4.5.3
1145651, 1143366	1992, Teratology study in rabbits with Troysan Polyphase P-100.final report, DACO:4.5.3
1157183	1994, Special report - Discussion of the weight of evidence for proposed carcinogenicity classification of Troysan Polyphase P-100, DACO: 4.4.2
1189556	1987, Iodopropynylbutyl carbamate (IPBC) 8 week dietary dose range finding study in mice. (5021;436144). DACO: 4.3.8
1202279, 4203282, 2390419	1986, Test for delayed contact hypersensivity in the albino guinea pig, DACO: 4.2.6
1203282	1986, Test for delayed contact hypersensitivity with "GORI Acrylgrund" in the albino guinea pig, DACO: 4.2.6
1206497, 1189555	Idopropynylbutyl carbamate (IPBC) - 4 week dietary dose range finding study in rats, DACO: 4.5.12
1206500	1986, Final Report: Troysan Polyphase: Oral (gavage) teratogenicity study in the rat, DACO: 4.5.2
1213758 1213769, 1206498, 1206499	1987, Final Report: Troysan Polyphase 2 generation oral (dietary administration) reproduction toxicity study in the rat (1 litter per generation) (511/3); and preliminary reports, DACO: 4.5.1
1221125	1988, Final Report – Troysan Polyphase. Oral (gavage) teratogenicity study in the mouse (511/12), DACO: 4.5.2
1235185, 1204501	1989, Test for delayed contact hypersensitivity with Troysan Polyphase P-100 in the albino guinea pig, DACO: 4.2.6
1235307	1990, (Troysan Polyphase P-100) - Acute inhalation toxicity study in the rat, DACO: 4.2.3
1235186 1235308	1988, 3-Iodo-2-propynyl butyl carbamate (IPBC) chronic dietary toxicity study in rats (435580).

1237251, 1157184, 1980791	1989, IPBC: 78-week dietary carcinogenicity study in mice (7304); with 1994 histopathological evaluation mouse livers, DACO: 4.4.3
1241702	1993, Single Dose Oral Toxicity in Rats/LD50 in Rats., DACO: 4.2.1
1241703	1993, Acute Dermal Toxicity in Rabbits/LD50 In Rabbits, DACO: 4.2.2
1241704	1994, Acute Inhalation Toxicity in Rats: 4-hour Exposure to Omacide IPBC., DACO: 4.2.3
1241705	1993, Primary Eye Irritation and/or Corrosion In Rabbits, DACO: 4.2.4, 4.2.9
1241706	1993, Primary Dermal Irritation in Albino Rabbits, DACO: 4.2.2
1241707	1993, Delayed Contact Dermal Sensitization (Buehler Method) (in Guinea Pig), DACO: 4.2.6
1241708	1994, Omacide (IPBC)14 Day Oral (Gavage) Toxicity Study in the Rat, DACO: 4.2.1,4.2.9
1241709	1994, Omacide IPBC 5-day Repeat Dose Inhalation Toxicity Study in Rats, DACO: 4.2.3,4.2.9
1241710	1994, Omacide IPBC 2-Week Repeat Dose Inhalation Toxicity Study in Rats, DACO: 4.2.3,4.2.9
1241711	1994, Omacide (IPBC) 13 Week Oral (Gavage) Toxicity Study in the Rat, DACO: 4.3.1
1241712	1994, Omacide IPBC 13-Week Inhalation Toxicity Study in Rats, DACO: 4.3.6
1241713	1994, Omacide (IPBC) Oral (Gavage) Rat Developmental Toxicity Dose Ranging Study, DACO: 4.5.2
1241714	1994, Omacide (IPBC) Oral (Gavage) Rat Developmental Toxicity (Teratology) Study, DACO: 4.5.2
1241715	1994, Omacide (IPBC) Oral (Gavage) Rabbit Developmental Toxicity Dose Ranging Study, DACO: 4.5.3
1241716	1994, Omacide (IPBC) Oral (Gavage) Rabbit Developmental Toxicity Study, DACO: 4.5.3
1241717	1993, CHO/HGPRT Mutation Assay with Confirmation Omacide IPBC, DACO: 4.5.5
1241718	1993, Micronucleus Cytogenetic Assay in Mice, DACO: 4.5.7
1241719	1993, Salmonella/Mammalian-Microsome Plate Incorporation Mutagenicity Assay (Ames Test) and Escherichia coli WP2 uvra Reverse Mutation Assay with a Confirmation Assay, DACO: 4.5.4
1241720	1996, Oral Gavage Rat One Generation Reproductive Toxicity Study (Expanded to Two Generation), DACO: 4.5.1, 4.7.7
1241721	1997, Chronic studies summaries from the U.S. EPA, Chronic/Oncogenicity - USEPA Reregistration Eligibility Decision (RED) 3-Iodo-2-Propynyl butylcarbamate (IPBC), DACO: 12.5,4.4.4
1241722	2001, Acute Oral Neurotoxicity Study with 3-Iodopropynylbutyl Carbamate (IPBC) Administered by Gavage in CD Rats, DACO: 4.5.10
1241723 1241796	2001, 13 Week Dietary Neurotoxicity Study with 3-Iodopropynylbutyl Carbamate (IPBC) in CD Rats, DACO: 4.5.11
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1993588	1995, Metabolism of 14C-IPBC in Rats.
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PMRA#	Reference
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1260314	2001, Product Chemistry, Chemical and Physical Properties, Manufacturing-Use Product Chemistry Data and Confidential Business Attachment and Appendix 1-9 Material Safety Data Sheets, DACO: 0.9.1,2.1,2.11.1,2.11.2,2.11.3,2.11.4,2.14.1,2.14.10,2.14.11,2.14.

B. ADDITIONAL INFORMATION CONSIDERED

i) Published Information

Chemistry

PMRA #	Reference
1968050	Canada 2010, Proposed Re-evaluation Decision,Iodocarb. PRVD2010-15

Human Health

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1241721	1997, U.S. EPA, Chronic/Oncogenicity -USEPA Reregistration Eligibility Decision (RED) 3-Iodo-2-Propynyl butylcarbamate (IPBC), DACO: 12.5,4.4.4
2624324	Lewis, D. J . (1991) Morphological assessment of pathological changes within the rat larynx Tox. Pathol. 19, 4(1), 352 - 357
2624327	CLH Report For 3-Iodo-2-Propynyl Butylcarbamate (IPBC) CAS NO. 55406-53-6 http://echa.europa.eu/documents/10162/13626/clh_3-iodo-2propynyl_butylcarbamate_en.pdf
1157185	R.H. Alison et al. (1994). Neoplastic lesions of questionable significance to humans. Toxicologic Pathology; Vol 22 No.2; pp.179-183, DACO: 4.4.2
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2624325 2012, IPBC (Troysan KK-108A) Amended Final Work Plan Registration Review, December 2012, Case Number: 2725
Author: United States Environmental Protection Agency

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